

EUNIS 25th
2018 PARIS



e-Assessment: Ensuring Equality of Treatment in a BYOD-Setting

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E-Assessment and Bring Your Own Device

Our Project: FLEX



FLEX (Framework for FLExible Electronic EXaminations)

Statement of the Problem

- Equality of Treatment
 - Ethically important
 - Can be required by law
- For paper-based examinations, an accepted modus operandi exists, but 100% equal treatment of the students not possible either
- Equality of Treatment is even harder to achieve in a BYOD setting

E-Assessment and Bring Your Own Device

Why is BYOD so difficult?

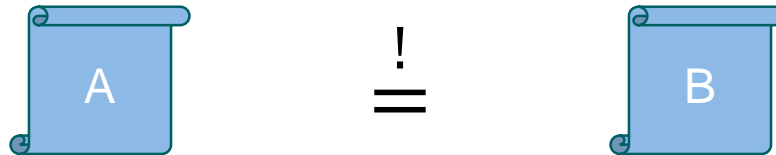
- Students' devices expectedly differ from each other
- Simple assignments may not expose these differences, but complex assignments will
- Complex assignments are wanted for e-Assessment, since these are the realistic ones



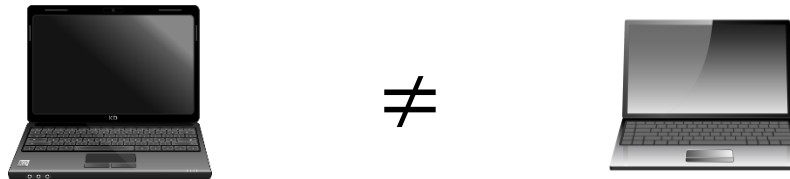
Our Approach

Preliminary Considerations

- Randomly generated exams are considered fair, if every student faces the same amount of work and difficulty



- The students' devices may not only differ in terms of performance (cpu, memory), but also in terms of available hardware (touchscreen, ...)



Our Approach

Goal

Take into account the **capabilities** of the different devices of the students and generate **individualized exams** of **equal difficulty**

Our Approach

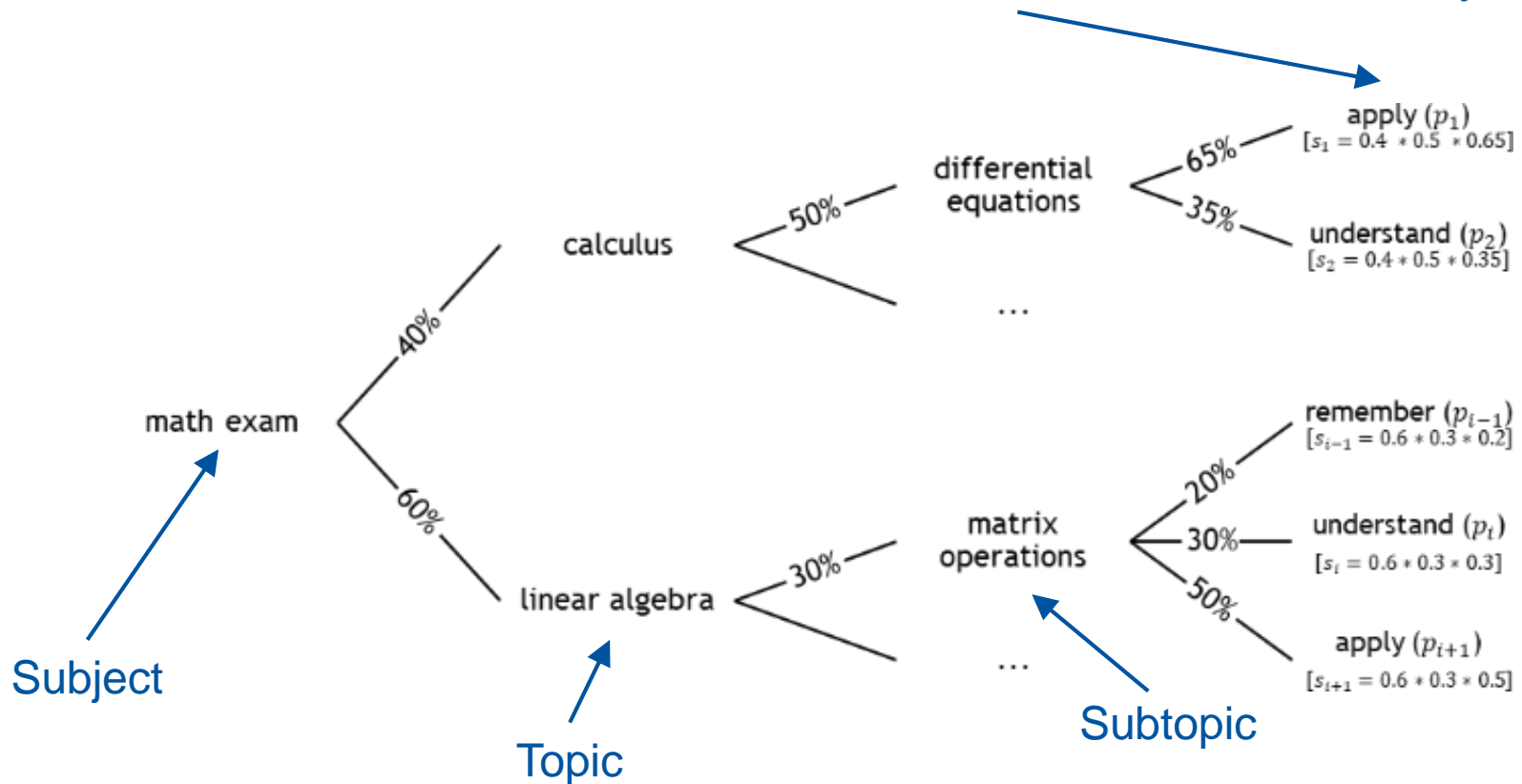
Workflow

1. Exam Blueprint
2. Assignment Pool Slicing
3. Assignment Rating
4. Exam Composition

Our Approach

Exam Blueprint

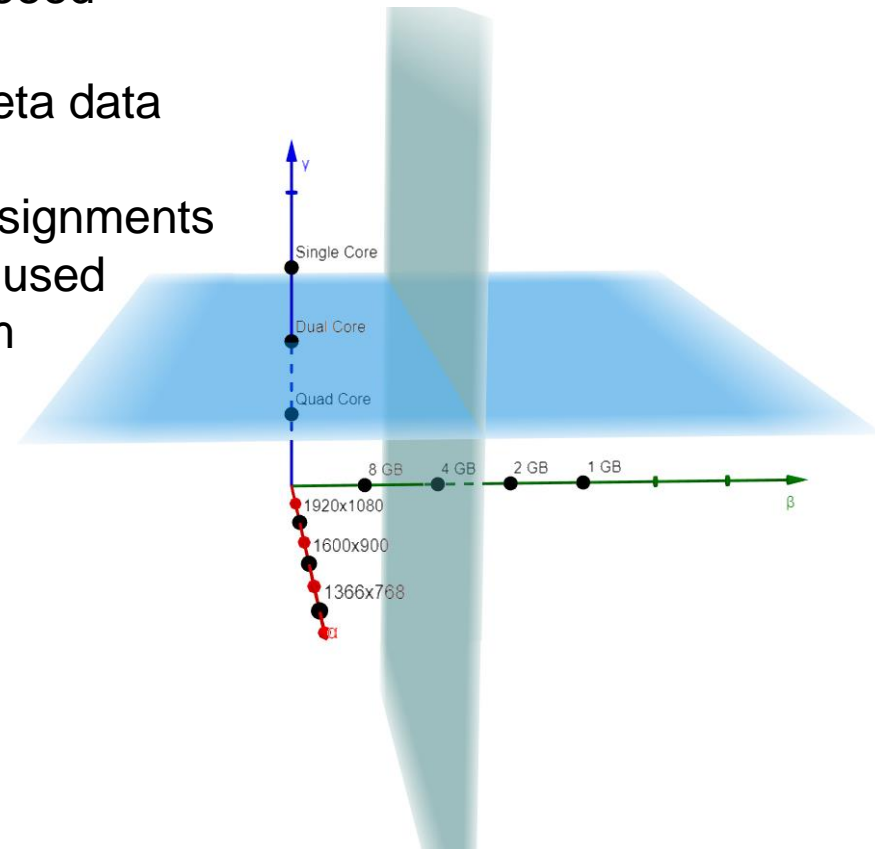
Krathwohl's Revised Version of Bloom's Taxonomy



Our Approach

Assignment Pool Slicing

- Quality assured assignment pool needed
- Each assignment is labeled with meta data
- Based on the meta data, certain assignments are considered feasible and will be used for a particular instance of the exam blueprint

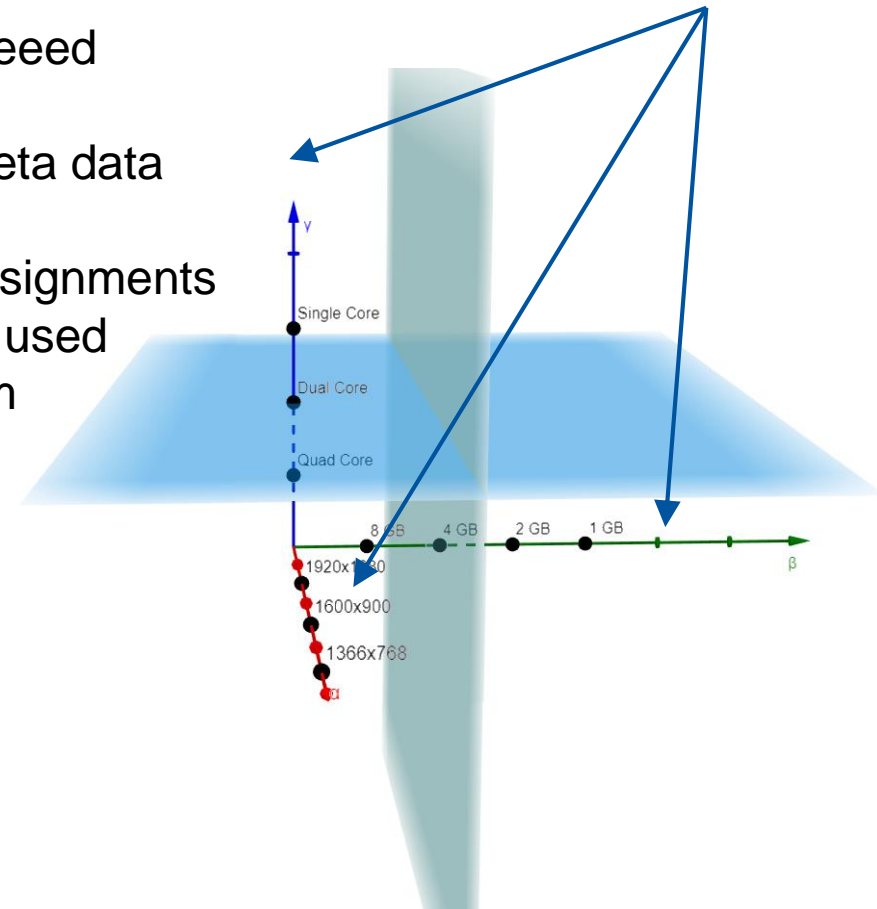


Our Approach

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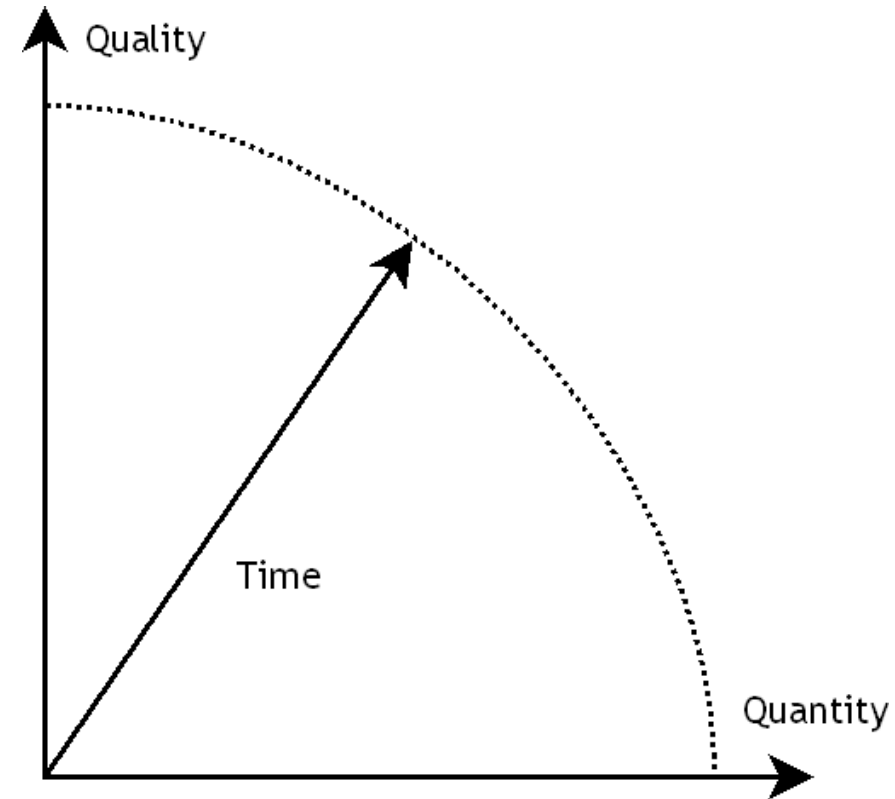
Capabilities of Student's Devices



Our Approach

Assignment Rating

- The value of an assignment is composed of two factors:
 - Quality (= difficulty)
 - Quantity (= how much to do?)
- Both factors influence the time needed for solving the assignment



Our Approach

Exam Composition

- Based on the blueprint, the sliced assignment pool and the rated assignments, for each student an individualized exam is created at random
- But... how to ensure Equality?

Our Approach

Exam Composition

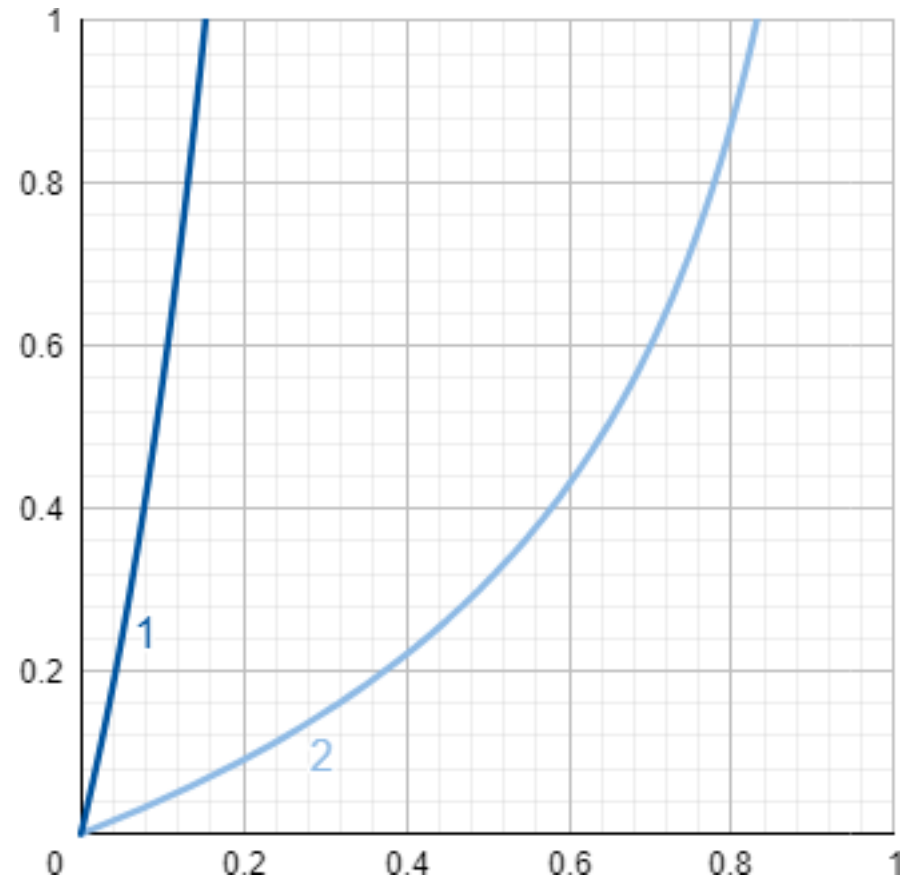
- Based on the blueprint, the sliced assignment pool and the rated assignments, for each student an individualized exam is created at random
- But... how to ensure Equality?

$$d_i = e^{\frac{n_p}{\varepsilon_p} * \left| \ln(1 - \Delta_i) * \ln\left(1 - \frac{\varepsilon_p * \varepsilon_t}{n_p * n_t}\right) * \ln\left(\frac{\delta^{(\varepsilon_p \varepsilon_t)}}{n_p * n_t}\right) \right|} - 1, \delta \in (0,1]$$

Our Approach

Exam Composition II

- The formula computes a score for a generated exam
- The score is, basically, the distance to the exam blue print
- If the distance is too large, the generated exam is discarded and a new one is generated randomly



Summary

- Our approach is based on the well-known method of generating individualized exams from a task pool and adds further constraints on a per-student basis
- The constraints relate to the capabilities of the student's devices
- Exams are generated by random sampling from a task pool and then checking whether the result fits the exam blue print
 - A quality-assured task pool is needed to ensure high quality of exams
 - May take several trials

Thanks for your attention! 😊

Are there any questions or comments?

